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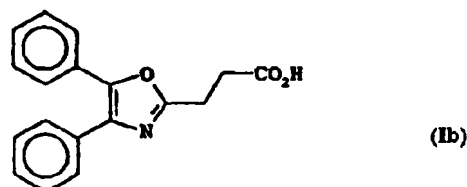
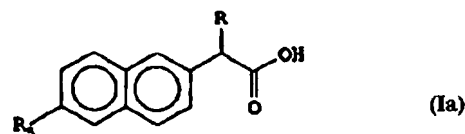
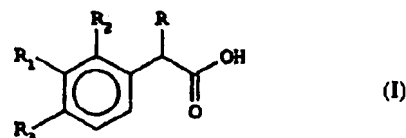
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(54) Title: SOLUTIONS OF ARYL OR HETEROARYL SUBSTITUTED ALKANOIC ACIDS IN LIPOPHILIC SOLVENTS AND SOFT GELATIN CAPSULES CONTAINING SUCH SOLUTIONS

(57) Abstract

Methods and compositions are disclosed for preparing liquid mixtures of aryl or heteroaryl alkanolic acids suitable for encapsulation in soft gelatin capsules. The compositions comprise alkanolic acids of formulas (I), (Ia), (Ib) or pharmaceutically acceptable salts thereof, wherein R, R₁, R₂, R₃, and R₅ represent hydrogen or various organic substituents, and an effective solubilizing amount of at least one lipophilic solvent.



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**SOLUTIONS OF ARYL OR HETEROARYL SUBSTITUTED
ALKANOIC ACIDS IN LIPOPHILIC SOLVENTS AND
SOFT GELATIN CAPSULES CONTAINING SUCH SOLUTIONS**

5 **BACKGROUND OF THE INVENTION**

Field of the Invention

 The present invention relates to solutions containing
therapeutically useful substituted alkanolic acids in combination
with at least one lipophilic solvent for encapsulation in soft
10 gelatin capsules (softgel capsules).

Description of the Related Art

 Hydrophilic softgels are well known for the oral
administration of pharmaceutical agents. Typically, softgel
capsules consist of an outer shell of gelatin containing a
15 plasticizer and an inner filling of hydrophilic liquid containing
a dissolved hydrophobic pharmaceutical agent. The plasticizer
is chosen so that the solubility in the fill liquid is as low as
possible. If the plasticizer is soluble in the fill liquid, it
can migrate out of the shell over time into the fill, leaving the
20 shell brittle and subject to rupture.

 With respect to pharmaceutical agents of relatively low
solubility and/or relatively high dosage amount, softgel capsules
can pose problems for the pharmaceutical formulator. For
example, if a given pharmaceutical agent has a relatively low
25 solubility, it may need a relatively large volume of solution in
order to deliver a pharmaceutically acceptable unit dose. While
theoretically possible to encapsulate such a large volume of
solution in a softgel capsule, for example, the practical

-2-

limitations on the size of capsules suitable for conventional oral administration to human patients could well preclude pharmaceutical use of the resulting softgel.

Similarly, if a pharmaceutical agent requires a relatively high dose, a large volume of solution may again be a necessity for delivery of the require dosage. Softgel encapsulation of such a large solution volume may be impractical because the size of the needed softgel would likely exceed the maximum limit for conventional oral administration to human patients.

As one approach to handling the problems of encapsulating low solubility or high dose pharmaceutical agents, U.S. Patent No. 5,071,643 (Yu et. al.) discloses the use of polyethylene glycol based solutions for acidic, basic and amphoteric pharmaceutical agents. These polyethylene glycol based solutions contain either an hydroxide species or a hydrogen ion species that causes the appropriate pharmaceutical agent to partially ionize, i.e., the pharmaceutical agent is present in both the free form and the salt form. The partial ionization described in Yu et al. results in enhanced solubility for the acidic, basic or amphoteric pharmaceutical agent. This enhanced solubility, in turn, may permit the preparation of a solution of pharmaceutical agent that is highly concentrated enough to be encapsulated in a capsule acceptably sized for oral administration to human patients. The Yu et al. patent discloses that enhanced solubility solutions can be prepared using polyethylene glycol and contemplated equivalents of polyethylene

-3-

glycol, such as polyethylene glycol ethers or various alcohols and copolymers of polyethylene glycol.

Softgel encapsulation is sometimes the preferred delivery system for many pharmaceutical agents that are administered orally to human patients. Generally, to be suitable for softgel encapsulation, a pharmaceutical formulation should be in the form of a clear, stable solution. The present inventors have discovered that the enhanced solubility solutions disclosed by the Yu et al. patent are not as effective with various substituted alkanolic acid pharmaceutical agents.

Therapeutically useful 2- or 3-aryl or 2- or 3-heteroaryl substituted alkanolic acids function as anti-inflammatory and analgesic agents and may be administered orally. They are also essentially insoluble in water. An example of such a useful alkanolic acid suitable for use in the present invention is ketoprofen which is 2-(3-benzoylphenyl) propionic acid.

Ketoprofen is an anti-inflammatory, analgesic agent that is principally indicated for the acute and long-term management of rheumatoid arthritis and osteoarthritis. Additionally it is a nonsteroidal compound and poorly water soluble. Some gastrointestinal irritation is ordinarily associated with oral dosage forms of ketoprofen. The properties of ketoprofen render it a good candidate for formulation with the enhanced solubility solutions disclosed in the Yu et al. patent. In a number of experiments, the present inventors applied the Yu et al. enhanced solubility solutions in formulations of ketoprofen for softgel encapsulation.

-4-

In one formulation, polyethylene glycol 400 and potassium hydroxide were used to solubilize the ketoprofen, with the mole ratio of potassium hydroxide to ketoprofen being in the range of 0.4 to 1. It was surprisingly found that the resulting formulation was not sufficiently stable for softgel encapsulation due to the undesirable formation of ketoprofen esters.

In an attempt to completely ionize the ketoprofen to prevent the formation of undesirable esters, the potassium hydroxide to ketoprofen mole ratio was adjusted to range from 1.1 to 1. With this second formulation, concerns arose that the ketoprofen salt thus formed and/or the high pH caused by the excess potassium hydroxide used could affect the physical stability of the softgel capsule when the formulation was encapsulated. Additionally, if an equilibrium amount of the ketoprofen free acid remained in the solution, it could form ketoprofen esters that could drive the reaction to form more ketoprofen free acid species, which could eventually result in a chemically unstable formulation.

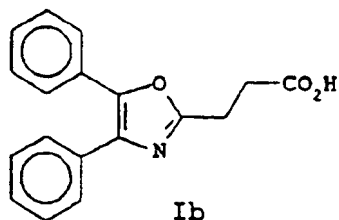
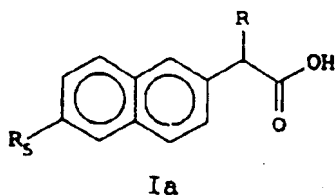
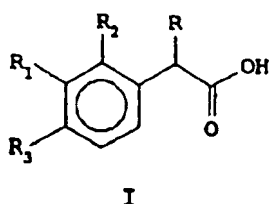
The present inventors have discovered that non-hydroxyl containing solvents may be used to form pharmaceutically acceptable solutions of 2- or 3-aryl or 3-heteroaryl substituted alkanolic acids that are stable and suitable for softgel encapsulation.

-5-

SUMMARY OF THE INVENTION

The present invention provides enhanced solubility pharmaceutically acceptable solutions of therapeutically useful substituted alkanolic acids, preferably 2- or 3-aryl or 2- or 3-heteroaryl alkanolic acids, that can be encapsulated in softgel capsules of a size suitable for subsequent oral administration to human patients, having improved chemical stability compared with polyethylene glycol water miscible formulations of the alkanolic acids.

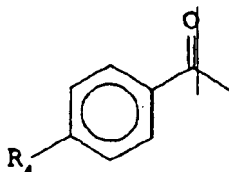
The therapeutically useful active agents, *i.e.*, substituted alkanolic acids, preferred for use in the present invention have general formulas I, Ia or Ib:



or pharmaceutically acceptable salts thereof, wherein

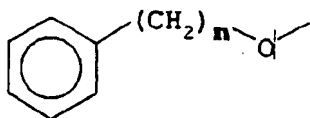
R represents a hydrogen atom or an alkyl group containing 1 to 4 carbon atoms;

R₁ represents hydrogen, halogen, C₁-C₆ alkyl, phenylalkyl where the alkyl is C₁-C₆ alkyl, a benzoyl group of the formula:



-6-

where R_4 represents hydrogen, C_1-C_6 alkyl, or an alkylthio group having 1 to 4 carbon atoms; or R_1 represents a group of the formula:



where n is 0, 1 or 2;

R_2 represents hydrogen, hydroxy or C_1-C_6 alkoxy;

10 R_3 represents hydrogen, C_1-C_6 alkyl or phenyl; and

R_5 is C_1-C_6 alkoxy.

The enhanced solubility pharmaceutically acceptable solutions of therapeutically useful alkanolic acids can be encapsulated in softgel capsules of a size suitable for subsequent oral administration to human patients, which improves the physical stability of the softgel capsules used to encapsulate the pharmaceutical solutions compared with polyethylene glycol water miscible formulations of the alkanolic acids.

15

20

The present invention also provides enhanced solubility pharmaceutically acceptable solutions of alkanolic acids that unexpectedly can be encapsulated in a softgel capsule of a size smaller than what is required to encapsulate the same dose of the acid in polyethylene glycol water miscible formulations.

25

The enhanced solubility pharmaceutically acceptable solutions of 2- or 3-aryl or 3-heteroaryl alkanolic acids provided

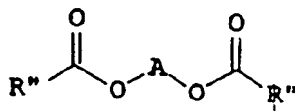
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by the present invention may reduce or eliminate the gastrointestinal irritation associated with oral dosage forms of these agents.

5 The lipophilic solvent and the hydroxyl containing softgel capsule plasticizers, such as glycerin, are immiscible, thereby improving both the chemical stability of the acid solution and improving the physical stability of the softgel capsule by greatly reducing the migration of capsule plasticizers into the encapsulated pharmaceutical formulation. Additionally, the use
10 of the lipophilic solvent prevents the formation of esters which can decrease the chemical stability of the alkanolic acid solution.

Suitable lipophilic solvents are polyol esters of fatty acids. The polyol esters of fatty acids may be mono-, di-, tri-,
15 etc, esters of the polyols. Thus, there may be free hydroxyl groups present in the polyol esters of fatty acids useful as lipophilic solvents of the invention.

The lipophilic solvent preferred for use in the present invention is an alkylene glycol derivative of formula II:

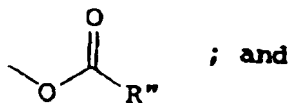


II

wherein

A represents C₁-C₄ alkylene optionally substituted with
25 alkyl or a group of the formula

-8-



the R'' groups are the same or different and represent C₁-C₁₂ alkyl.

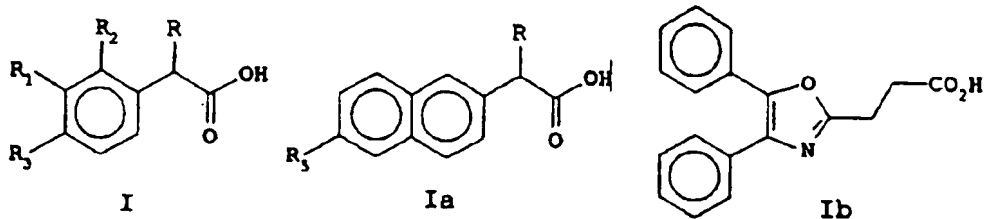
Further objects and embodiments of the present invention will be described in the following description of the preferred embodiments.

-9-

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention is useful for providing pharmaceutically acceptable solutions of substituted alkanolic acids dissolved in at least one lipophilic solvent, which are chemically stable and suitable for softgel encapsulation.

The therapeutically useful active agents, i.e., substituted alkanolic acids, preferred for use in the present invention have general formulas I, Ia or Ib:

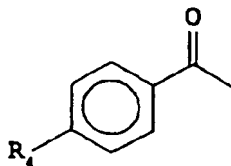


or pharmaceutically acceptable salts thereof,

wherein

R represents a hydrogen atom or an alkyl group containing 1 to 4 carbon atoms;

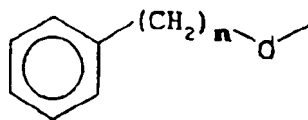
R₁ represents hydrogen, halogen, C₁-C₆ alkyl, phenylalkyl where the alkyl is C₁-C₆ alkyl, a benzoyl group of the formula:



where R₄ represents hydrogen, C₁-C₆ alkyl, or an alkylthio group having 1 to 4 carbon atoms; or

-10-

R_1 represents a group of the formula:



where n is 0, 1 or 2;

R_2 represents hydrogen, hydroxy or $\text{C}_1\text{-C}_6$ alkoxy;

R_3 represents hydrogen, $\text{C}_1\text{-C}_6$ alkyl or phenyl; and

R_5 is $\text{C}_1\text{-C}_6$ alkoxy.

Suitable pharmaceutically acceptable, non-toxic salts include salts such as, for example, alkali metal, alkaline earth metal, ammonium and amine salts. Compounds of general formulas I, Ia, and Ib in which R represents an alkyl group can exist in optically active forms, including isomers and racemates thereof. Preferred alkanolic acids suitable for use in the present invention include ketoprofen (formula I where R is methyl, R_1 is benzoyl, and R_2 and R_3 are hydrogen, *i.e.*, 2-(3-benzoylphenyl)propionic acid); ibuprofen (formula I where R is methyl, R_1 and R_2 are hydrogen, and R_3 is isobutyl, *i.e.*, 2-(4-isobutylphenyl)propionic acid); naproxen (formula Ia where R is methyl and R_5 is methoxy, *i.e.*, 2-(6-methoxy naphthyl)propionic acid); and oxaprozin, (formula Ib, *i.e.*, 4,5-diphenyl-2-oxazolepropionic acid).

The enhanced solubility pharmaceutically acceptable solutions of therapeutically useful substituted alkanolic acids can be encapsulated in softgel capsules of a size suitable for

-11-

subsequent oral administration to human patients, which improves the physical stability of the softgel capsules used to encapsulate the pharmaceutical solutions compared with polyethylene glycol water miscible formulations of the alkanolic acids.

5 The present invention also provides enhanced solubility pharmaceutically acceptable solutions of ketoprofen that can be encapsulated in a softgel capsule of a size smaller than what is required to encapsulate the same dose of the acids in polyethylene glycol water miscible formulations.

10 The present invention provides pharmaceutically acceptable solutions containing from about 0.1 to 1000 mg, preferably about 5 to 200 mg, and most preferably about 10 to 100 mg, of an alkanolic acid dissolved in at least one lipophilic solvent, resulting in a clear solution suitable for softgel encapsulation.

15 The lipophilic solvent and the hydroxyl containing softgel capsule plasticizers, such as glycerin, are immiscible, thereby improving both the chemical stability of the alkanolic acid solution and improving the physical stability of the softgel capsule by greatly reducing the migration of capsule plasticizers into the encapsulated pharmaceutical formulation. Additionally,

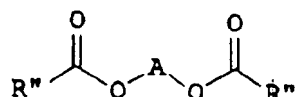
20 the use of the lipophilic solvent prevents the formation of esters which can decrease the chemical stability of the alkanolic acid solution.

25 Suitable lipophilic solvents are polyol esters of fatty acids. The polyol esters of fatty acids may be mono-, di-, tri-, etc, esters of the polyols. Thus, there may be free hydroxyl

-12-

groups present in the polyol esters of fatty acids useful as lipophilic solvents of the invention.

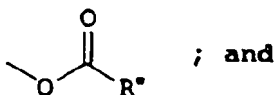
The lipophilic solvent preferred for use in the present invention is an alkylene glycol derivative of formula II:



II

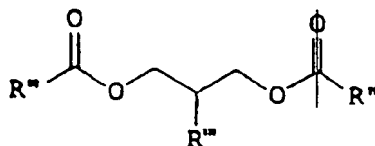
wherein

A represents $\text{C}_1\text{-C}_4$ alkylene optionally substituted with alkyl or



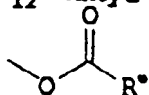
the R'' groups are the same or different and represent $\text{C}_1\text{-C}_{12}$ alkyl,

Suitable lipophilic solvents include those of formula III:



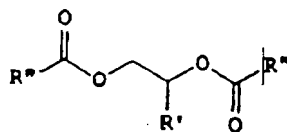
III

where the R'' groups are the same or different and represent $\text{C}_1\text{-C}_{12}$ alkyl and R''' is hydrogen or



-13-

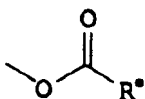
Suitable lipophilic solvents also include those of formula IV:



IV

where the R'' groups are the same or different and represent C₁-C₁₂ alkyl and R' is C₁-C₆ alkyl.

Other suitable lipophilic solvents are those of formula III where the R'' groups are the same and represent C₁-C₄ alkyl and R''' is



Still other suitable lipophilic solvents are those of formula IV where the R'' groups are the same or different and represent C₁-C₄ alkyl and R' is methyl.

Most preferred lipophilic solvents of formula III are those where R'' is methyl. Most preferred lipophilic solvents of formula IV are those where the R'' groups are the same or different and represent CH₃(CH₂)₆ or CH₃(CH₂)₈.

Particularly preferred solvents are selected from the group consisting of propylene glycol dicaprylate/dicaprate, 1,2,3-propanetriol triacetate and mixtures thereof. Most preferably the solvents suitable for use in the present invention include

-14-

propylene glycol dicaprylate/dicaprate, 1,2,3-propanetriol triacetate and mixtures thereof. Propylene glycol dicaprylate/dicaprate is available under the trade name Captex 200 from Karlshamn Lipid Specialties and 1,2,3-propanetriol triacetate is available under the trade name Triacetin from Eastman Chemicals.

The inventive solutions may also contain optional, additional ingredients to improve the dispersivity and dissolution of the substituted alkanolic acid. Suitable additional components include surfactants such as, for example, polyglyceryl esters of fatty acids, polyglycolized glycerides, propylene glycol esters, mono- and di-glycerides, sorbitan fatty acid esters, polyoxyethylene sorbitan fatty acid esters, polyoxyethylene sorbitol esters, polyoxyethylene acids, polyoxyethylene alcohols, and mixtures thereof. A preferred class of surfactants for use in combination with the lipophilic solvents is the polyoxyethylene sorbitan fatty acid esters. Suitable sorbitan esters are sold under the trade name Tween. A particularly useful Tween is polyoxyethylene (20) sorbitan mono-oleate (Tween 80).

The active substituted alkanolic acid pharmaceutical agent may be present in the solution in amounts ranging up to about 30% by weight of the solution. Preferred concentrations of the active agent are from about 5-20%, more preferably about 10-15%, by weight of the final solution. Combinations of lipophilic solvents may be used to obtain a desired final concentration.

-15-

For example, ketoprofen may be present in the solution in amounts ranging up to about 5% by weight of the solution when dissolved only in propylene glycol dicaprylate/dicaprate. Ketoprofen may be present in the solution in amounts ranging up to about 14% by weight of the solution when dissolved only in 1,2,3-propanetriol triacetate. When dissolved in a mixture of propylene glycol dicaprylate/dicaprate, 1,2,3-propanetriol triacetate and Tween, the ketoprofen pharmaceutical agent may be present in solution in amounts ranging up to about 22% by weight of solution.

In addition to the ketoprofen pharmaceutical agent and the lipophilic solvents, other adjuncts may optionally be present. Polyoxyethylene (20) sorbitan mono-oleate (Tween 80) may be included in the solution up to about 50% by weight of the solution.

Once the appropriate pharmaceutically acceptable solution of the substituted alkanolic acid is formulated, it can be encapsulated into conventional softgel capsules using any suitable encapsulation method, such as for example, the rotary die process.

All documents, e.g., patents and journal articles, cited above or below are hereby incorporated by reference in their entirety.

One skilled in the art will recognize that modifications may be made in the present invention without deviating from the spirit or scope of the invention. The invention is illustrated further by the following examples which are not to be construed

-16-

as limiting the invention or scope of the specific procedures described herein.

Example 1

5 Pharmaceutically acceptable solutions containing ketoprofen are prepared in the following manner. First, mix the following until homogeneous:

(1) about 92 mg of propylene glycol dicaprylate/dicaprate;

(2) about 92mg of 1,2,3-propanetriol acetate; and

10 (3) about 10 mg of polyoxyethylene (20) sorbitan mono-oleate.

Second, add about 25 mg of ketoprofen to the homogeneous mixture of propylene glycol dicaprylate, 1,2,3-propanetriol acetate and polyoxyethylene (20) sorbitan mono-oleate, and mix again. While
15 mixing in the ketoprofen, heat the mixture and maintain the temperature between 110-125°F until the ketoprofen is dissolved. Once the ketoprofen is fully dissolved, the solution is then cooled and deaerated. After being cooled and deaerated, the ketoprofen solution can be encapsulated in suitable softgel
20 capsules, such as 4 oval softgel. The filled softgel capsules are thereafter dry finished to the appropriate hardness.

Example 2

25 Pharmaceutically acceptable solutions containing ketoprofen are prepared in the following manner. First, mix the following until homogeneous:

-17-

(1) about 112 mg of propylene glycol dicaprylate/dicaprate;

(2) about 72 mg of 1,2,3-propanetriol acetate; and

(3) about 14 mg of polyoxyethylene (20) sorbitan mono-oleate.

Second, add about 25 mg of ketoprofen to the homogeneous mixture of propylene glycol dicaprylate, 1,2,3-propanetriol acetate and polyoxyethylene (20) sorbitan mono-oleate, and mix again. While mixing in the ketoprofen, heat the mixture and maintain the temperature between 110-125°F until the ketoprofen is dissolved. Once the ketoprofen is fully dissolved, the solution is then cooled and deaerated. After being cooled and deaerated, the ketoprofen solution can be encapsulated in suitable softgel capsules, such as 4 oval softgel. The filled softgel capsules are thereafter dry finished to the appropriate hardness.

Example 3

Pharmaceutically acceptable solutions containing up to about 22% ketoprofen by weight of solution are prepared in the following manner, which provides a self-emulsifying system. First, mix the following until homogeneous:

(1) propylene glycol dicaprylate/dicaprate in an amount ranging from about 40% to about 98% by weight;

(2) 1,2,3-propanetriol acetate in an amount ranging from about 1% to about 55% by weight; and

(3) polyoxyethylene (20) sorbitan mono-oleate in an amount ranging from about 1% to about 50% by weight.

-18-

Second, add ketoprofen to the homogeneous mixture of propylene glycol dicaprylate, 1,2,3-propanetriol triacetate and polyoxyethylene (20) sorbitan mono-oleate, and mix again. While mixing in the ketoprofen, heat the mixture and maintain the temperature between 110-125°F until the ketoprofen is dissolved. Once the ketoprofen is fully dissolved, the solution is then cooled and deaerated. After being cooled and deaerated, the ketoprofen solution can be encapsulated in suitable softgel capsules. The filled softgel capsules are thereafter dry finished to the appropriate hardness.

Example 4

Pharmaceutically acceptable solutions containing up to about 14% ketoprofen by weight of solution are prepared in the following manner. First, mix the following until homogeneous:

(1) propylene glycol dicaprylate/dicaprate in an amount ranging from about 1% to about 50% by weight; and

(2) 1,2,3-propanetriol acetate in an amount ranging from about 50% to about 99% by weight.

Second, add ketoprofen to the homogeneous mixture of propylene glycol dicaprylate and 1,2,3-propanetriol acetate and mix again. While mixing in the ketoprofen, heat the mixture and maintain the temperature between 110-125°F until the ketoprofen is dissolved. Once the ketoprofen is fully dissolved, the solution is then cooled and deaerated. After being cooled and deaerated, the ketoprofen solution can be encapsulated in suitable softgel

-19-

capsules. The filled softgel capsules are thereafter dry finished to the appropriate hardness.

Example 5

5 Pharmaceutically acceptable solutions containing up to about
5% ketoprofen by weight of solution are prepared by mixing the
ketoprofen with propylene glycol dicaprylate/dicaprate while
heating the mixture. The temperature of the mixture should be
maintained between 110-125°F until the ketoprofen is dissolved.
10 Once the ketoprofen is fully dissolved, the solution is then
cooled and deaerated. After being cooled and deaerated, the
ketoprofen solution can be encapsulated in suitable softgel
capsules. The filled softgel capsules are thereafter dry
finished to the appropriate hardness.

15

Example 6

Pharmaceutically acceptable solutions containing up to about
14% ketoprofen by weight of solution are prepared by mixing the
ketoprofen with 1,2,3-propanetriol acetate while heating the
mixture. The temperature of the mixture should be maintained
20 between 110-125°F until the ketoprofen is dissolved. Once the
ketoprofen is fully dissolved, the solution is then cooled and
deaerated. After being cooled and deaerated, the ketoprofen
solution can be encapsulated in suitable softgel capsules. The
25 filled softgel capsules are thereafter dry finished to the
appropriate hardness.

-20-

Example 7

The following formulations are prepared according to the invention using the procedure set forth above in Example 1.

Ingredient	A (mg)	B (mg)	C (mg)
5 Propylene glycol dicaprylate/dicaprate	92	184	276
1,2,3-Propanetriol triacetate	92	184	276
Polyoxyethylene (20) sorbitan mono-oleate	10	20	30
10 Ketoprofen	25	50	75
Final softgel size	4 oval	7.5 oval	12 oval

Example 8

The following comparative formulations are prepared essentially as in the procedure set forth above in Example 1 but do not include the lipophilic solvent according to the invention.

Ingredient	D (mg)	E (mg)	F (mg)
Water	5.46	10.92	16.38
Potassium hydroxide	6.06	12.12	18.18
20 Polyoxyethylene glycol 400	438.48	876.96	1315.44
Propylene glycol	25	50	75
Ketoprofen	25	50	75
Final softgel size	12 oval	20 oval	30 oval

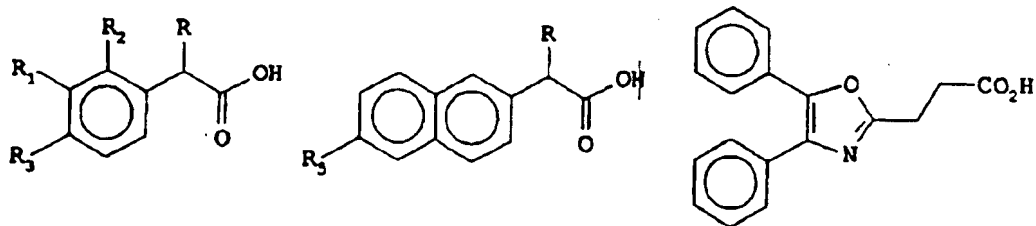
Certain specific embodiments of the present invention have been discussed and disclosed in detail. Many other embodiments

-21-

that have not been disclosed or described are nevertheless the equivalent of and fall within the scope of the present invention and/or the following claims.

WE CLAIM:

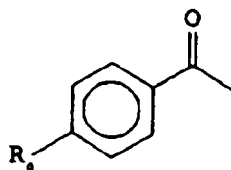
1. A pharmaceutical composition comprising alkanolic acids selected from the group consisting of alkanolic acids of the formulas:



or pharmaceutically acceptable salts thereof,
wherein

R represents a hydrogen atom or an alkyl group containing
1 to 4 carbon atoms;

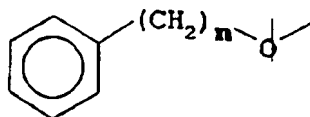
10 R_1 represents hydrogen, halogen, C_1 - C_6 alkyl, phenylalkyl
where the alkyl is C_1 - C_6 alkyl, a benzoyl group of the
formula:



where R_4 represents hydrogen, C_1 - C_6 alkyl, or an
alkylthio group having 1 to 4 carbon atoms; or

20 R_1 represents a group of the formula:

-23-



where n is 0, 1 or 2;

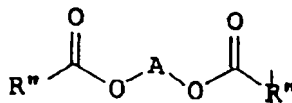
R_2 represents hydrogen, hydroxy or $\text{C}_1\text{-C}_6$ alkoxy;

R_3 represents hydrogen, $\text{C}_1\text{-C}_6$ alkyl or phenyl; and

R_5 is $\text{C}_1\text{-C}_6$ alkoxy.

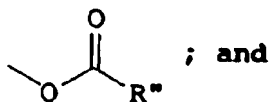
the 2-phenyl or naphthyl alkanolic acid being solubilized in a lipophilic solvent.

2. A pharmaceutical composition according to Claim 1 wherein the lipophilic solvent has the formula:



wherein

A represents $\text{C}_1\text{-C}_4$ alkylene optionally substituted with alkyl or

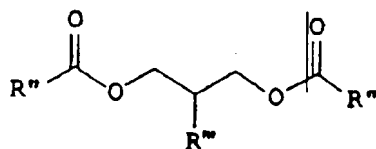


; and

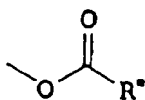
the R'' groups are the same or different and represent $\text{C}_1\text{-C}_{12}$ alkyl.

-24-

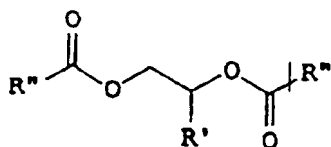
3. A pharmaceutical composition according to Claim 1 wherein the lipophilic solvent has the formula:



where the R'' groups are the same or different and represent C₁-C₁₂ alkyl and R''' is hydrogen or

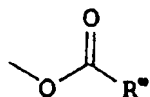


4. A pharmaceutical composition according to Claim 1 wherein the lipophilic solvent has the formula:



where the R'' groups are the same or different and represent C₁-C₁₂ alkyl and R' is C₁-C₆ alkyl.

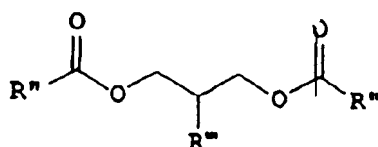
5. A pharmaceutical composition according to Claim 3, where the R'' groups are the same and represent C₁-C₄ alkyl and R''' is



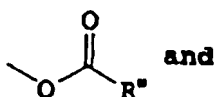
-25-

6. A pharmaceutical composition according to Claim 4, where the Rⁿ groups are the same or different and represent C₁-C₄ alkyl and R' is methyl.

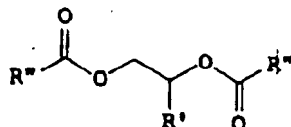
7. A pharmaceutical composition according to Claim 1, wherein the lipophilic solvent comprises a mixture of a alkylene glycol derivative of the formula:



where the Rⁿ groups are the same or different and represent C₁-C₁₂ alkyl and R^{n'} is hydrogen or



a alkylene glycol derivative of the formula:



where the Rⁿ groups are the same or different and represent C₁-C₁₂ alkyl and R' is C₁-C₆ alkyl.

8. A pharmaceutical composition of Claim 1 wherein at least one lipophilic solvent has no free hydroxyl groups.

-26-

9. A pharmaceutical composition comprising ketoprofen, naproxen, oxaprozin or ibuprofen solubilized up to 14% by weight in 1,2,3-propanetriol triacetate.

5 10. A pharmaceutical composition comprising ketoprofen, ibuprofen, oxaprozin or naproxen solubilized up to 5% by weight in propylene glycol dicaprylate/dicaprate.

10 11. The pharmaceutical composition of Claim 9, wherein the ketoprofen, naproxen, oxaprozin or ibuprofen is solubilized in a mixture of 1 to 50% by weight of propylene glycol dicaprylate/dicaprate and 50 to 99% by weight of 1,2,3-propanetriol triacetate.

15 12. A pharmaceutical composition comprising ketoprofen, oxaprozin, naproxen, oxaprozin or ibuprofen solubilized up to 22% by weight in a mixture of 40 to 98% by weight of propylene glycol dicaprylate/dicaprate, 1 to 55% by weight of 1,2,3-propanetriol triacetate, and 1 to 50% by weight of a surfactant.

20 13. A solution comprising from about 0.1 to about 30% by weight of ibuprofen, naproxen, oxaprozin or ketoprofen in a lipophilic solvent.

25 14. A solution according to Claim 13, comprising from about 5 to about 20% by weight of ibuprofen, naproxen, oxaprozin or ketoprofen in a lipophilic solvent.

-27-

15. A solution according to Claim 13, comprising from about 10 to about 15% by weight of ibuprofen, naproxen, oxaprozin or ketoprofen in a lipophilic solvent.

5 16. A soft gelatin capsule comprising a solution of ketoprofen, naproxen, or ibuprofen in a lipophilic solvent.

10 17. A soft gelatin capsule according to Claim 16, wherein the amount of ketoprofen, naproxen, oxaprozin or ibuprofen in the solution is from about 10 to 15% by weight of the solution.

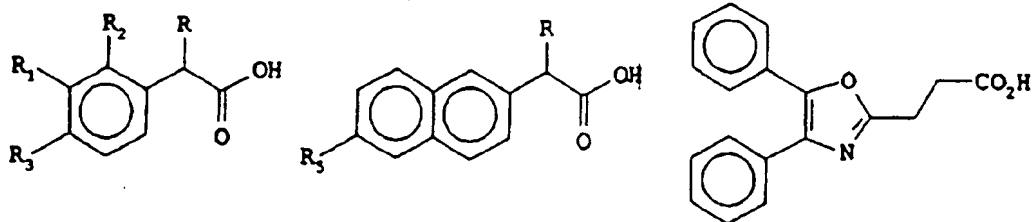
18. A solution according to Claim 13, wherein the lipophilic solvent is suitable for encapsulation by a gelatin shell.

15 19. A pharmaceutical composition comprising an amount of ketoprofen, ibuprofen, oxaprozin or naproxen effective to produce analgesia in a patient, the ketoprofen, ibuprofen, oxaprozin or naproxen being present as a solution in a pharmaceutically acceptable lipophilic solvent.

20

5 20. A method for preparing a liquid mixture of a 2- or 3-aryl or 3-heteroaryl alkanolic acid suitable for encapsulation in a soft gelatin capsule comprising mixing a 2- or 3-aryl or 3-heteroaryl alkanolic acid of the formula;

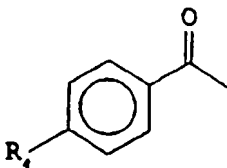
-28-



or pharmaceutically acceptable salts thereof,
wherein

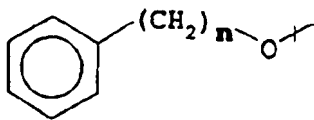
R represents a hydrogen atom or an alkyl group containing
1 to 4 carbon atoms;

R₁ represents hydrogen, halogen, C₁-C₆ alkyl, phenylalkyl
where the alkyl is C₁-C₆ alkyl, a benzoyl group of the
formula:



where R₄ represents hydrogen, C₁-C₆ alkyl, or an
alkylthio group having 1 to 4 carbon atoms; or

R₁ represents a group of the formula:



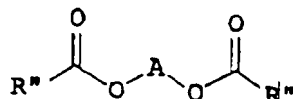
where n is 0, 1 or 2;

R₂ represents hydrogen, hydroxy or C₁-C₆ alkoxy;

R₃ represents hydrogen, C₁-C₆ alkyl or phenyl; and

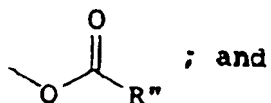
-29-

R_5 is C_1-C_6 alkoxy,
with an effective solubilizing amount of at least one lipophilic
solvent of the formula:



wherein

A represents C_1-C_4 alkylene optionally substituted with
alkyl or



the R'' groups are the same or different and represent C_1-C_{12}
alkyl.

5

INTERNATIONAL SEARCH REPORT

International Application No
PCT/US 95/06183

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61K31/19 A61K47/14

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US,A,5 059 626 (PARK MOO W ET AL) 22 October 1991	1-7,9, 10,13-20
Y	see column 1, line 59 - line 60; example 1; table II	8,11,12
X	WO,A,92 08445 (AFFINITY BIOTECH INC) 29 May 1992	1-6,9, 10,13-20
Y	see claims 1-3	7,8,11, 12
X	US,A,4 727 109 (SCHMIDT PETER C ET AL) 23 February 1988	1-7,9, 13-20
Y	see claims 1-8; examples 4,7,8	8,10-12
Y	WO,A,92 10996 (MERRELL DOW PHARMA) 9 July 1992 see page 7, paragraph 1; claims 1-3	7,10
	-/--	

☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

28 September 1995

Date of mailing of the international search report

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INTERNATIONAL SEARCH REPORT

International Application No.

PCT/US 95/06183

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US,A,5 071 643 (YU MAN S ET AL) 10 December 1991 cited in the application see example IX; table 1 ---	1-20
A	WO,A,94 07488 (PFIZER ;AHMED IMRAN (US)) 14 April 1994 see the whole document -----	1-20

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/US 95/06183

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A-5059626	22-10-91	US-A- 4918103 US-A- 5011852	17-04-90 30-04-91
WO-A-9208445	29-05-92	US-A- 5110606 AU-B- 648483 AU-A- 9054191 CA-A- 2095819 EP-A- 0561874 JP-T- 5509332	05-05-92 21-04-94 11-06-92 14-05-92 29-09-93 22-12-93
US-A-4727109	23-02-88	DE-A- 3500103	10-07-86
WO-A-9210996	09-07-92	AT-T- 117200 AU-B- 647563 AU-A- 9067891 DE-D- 69106892 DE-T- 69106892 EP-A- 0563112 ES-T- 2069987 HU-B- 210565 HU-A- 64218 JP-T- 6503340 NZ-A- 240961	15-02-95 24-03-94 22-07-92 02-03-95 18-05-95 06-10-93 16-05-95 29-05-95 28-12-93 14-04-94 25-03-94
US-A-5071643	10-12-91	AU-B- 606367 AU-A- 8157387 CA-A- 1316823 DE-A- 3772760 EP-A, B 0293406 JP-T- 1502185 KR-B- 9406270 KR-B- 9408030 KR-B- 9408031 WO-A- 8802625 US-A- 5360615	07-02-91 06-05-88 27-04-93 10-10-91 07-12-88 03-08-89 14-07-94 01-09-94 01-09-94 21-04-88 01-11-94
WO-A-9407488	14-04-94	AU-B- 4839293 CN-A- 1089138 EP-A- 0662831 FI-A- 934387	26-04-94 13-07-94 19-07-95 08-04-94

INTERNATIONAL SEARCH REPORT

Information on patent family members

Internat'l Application No

PCT/US 95/06183

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO-A-9407488		HU-A- 68533	27-04-95
		NO-A- 951350	06-06-95
		PL-A- 308307	24-07-95
